

What is claimed is:

1. A field emission device comprising:
a substrate;
a cathode electrode formed on the substrate;
5 a gate insulating layer which is formed on the cathode electrode and has a through hole corresponding to part of the cathode electrode;
a gate electrode which has a gate hole corresponding to the through hole and is formed on the gate insulating layer; and
an emitter formed on the gate electrode exposed to the bottom of the through
10 hole;
wherein the emitter has a stack structure formed of a resistive material layer and an electron emission material layer containing a fine electron emission source formed on the resistive material layer.

15 2. The field emission device of claim 1, wherein the electron emission material layer includes one of carbon nanotubes and nano particles.

3. The field emission device of claim 1, wherein the electron emission material layer includes a conductive material.

20 4. The field emission device of claim 3, wherein the conductive material includes silver (Ag).

25 5. The field emission device of claim 2, wherein the electron emission material layer includes a conductive material.

6. The field emission device of claim 5, wherein the conductive material includes silver (Ag).

30 7. A method of manufacturing a field emission device, the method comprising:

(a) preparing a substrate structure in which a cathode electrode formed on a substrate, a gate insulating layer having a through hole through which part of the

cathode electrode is exposed formed on the cathode electrode, and a gate electrode having a gate hole corresponding to the through hole formed on the gate insulating layer are sequentially stacked;

5 (b) forming a sacrificial layer on the surface of the substrate structure and on an inner wall of the through hole other than the cathode electrode exposed to the bottom of the through hole;

(c) coating a resistive material on the surface of the substrate structure to a predetermined thickness, covering the through hole with the resistive material, and forming an electron emission material layer on the resistive material layer;

10 (d) performing lift-off for removing the sacrificial layer formed on the surface of the gate electrode and on an inner wall of the through hole using an etchant and forming an emitter formed of the resistive material layer and the electron emission material layer formed on the resistive material layer in an inner portion of the through hole; and

15 (e) firing the emitter.

8. The method of claim 7, wherein the resistive material layer is formed of one of a paste, a Sol-gel, or a slurry solution.

20 9. The method of claim 8, wherein the resistive material layer is formed of one of a paste, a Sol-gel, or a slurry solution.

10. The method of claim 9, wherein the resistive material contains one or mixture of SiO_2 , MgO , a-Si, p-Si.

25 11. The method of claim 7, wherein the electron emission material layer includes a conductive material and is formed of one of a paste, a Sol-gel, or a slurry solution.

30 12. The method of claim 11, wherein the conductive material is silver (Ag).

13. The method of claim 7, wherein the electron emission material layer and the resistive material layer include a photoimageable resin.

14. A method of manufacturing a field emission device, the method comprising:

(a) preparing a substrate structure in which a cathode electrode formed on a substrate, a gate insulating layer having a through hole through which part of the cathode electrode is exposed formed on the cathode electrode, and a gate electrode having a gate hole corresponding to the through hole formed on the gate insulating layer are sequentially stacked;

(b) forming a sacrificial layer on the surface of the substrate structure and on an inner wall of the through hole other than the cathode electrode exposed to the bottom of the through hole;

(c) forming a resistive material layer that prevents contact between an electron emission material layer used to form an emitter on the gate electrode and the sacrificial layer and does not react to at least one of the sacrificial layer and the electron emission material layer;

(d) coating the electron emission material on the surface of the substrate structure on which the sacrificial layer is formed, to a predetermined thickness and forming an electron emission material layer for covering the through hole with the electron emission material;

(e) performing lift-off for removing the sacrificial layer formed on the surface of the gate electrode and on an inner wall of the through hole using an etchant, removing the resistive material layer formed on the sacrificial layer and the electron emission material, and forming an emitter formed of the resistive material layer and the electron emission material layer in an inner portion of the through hole; and

(f) firing the emitter.

15. The method of claim 14, wherein the electron emission material includes one of carbon nanotubes or nano particles.

16. The method of claim 14, wherein the electron emission material layer includes a conductive material.

17. The method of claim 16, wherein the conductive material includes

silver (Ag).

18. The method of claim 14, wherein the resistive material layer includes at least one of SiO₂, MgO, a-Si, and p-Si.

19. The method of claim 14, wherein the resistive material layer is formed of one of a paste, a Sol-gel, or a slurry solution.

20. The method of claim 14, wherein the electron emission material layer includes a conductive material and is formed of one of a paste, a Sol-gel, or a slurry solution.

21. The method of claim 20, wherein the conductive material is silver (Ag).

22. The method of claim 14, wherein the electron emission material layer and the resistive material layer include a photoimageable resin.

23. The method of claim 14, wherein the resistive material layer is formed using a solution where polyvinyl alcohol is added to an IPA diluted solution IPA/H₂O.

24. A method of manufacturing a field emission device, the method comprising:

(a) preparing a substrate structure in which a cathode electrode formed on a substrate, a gate insulating layer having a through hole through which part of the cathode electrode is exposed formed on the cathode electrode, and a gate electrode having a gate hole corresponding to the through hole formed on the gate insulating layer are sequentially stacked;

(b) forming a sacrificial layer on the surface of the substrate structure and on an inner wall of the through hole other than the cathode electrode exposed to the bottom of the through hole;

(c) forming an isolation layer that isolates the sacrificial layer and a resistive material layer formed on the sacrificial layer from each other and does not react to at least one of the sacrificial layer and the resistive material layer;

(d) forming the resistive material layer having an electrical resistivity on the isolation layer;

(e) coating an electron emission material on the surface of the substrate structure on which the isolation layer is formed, to a predetermined thickness and forming an electron emission material layer for covering the through hole with the electron emission material;

(f) performing lift-off for removing the sacrificial layer formed on the surface of the gate electrode and on an inner wall of the through hole using an etchant, removing the isolation layer formed on the sacrificial layer, the resistive material layer, and the electron emission material, and forming an emitter formed of the resistive material layer and the electron emission material layer in an inner portion of the through hole; and

(g) firing the emitter.

25. The method of claim 24, wherein the electron emission material includes one of carbon nanotubes or nano particles.

26. The method of claim 24, wherein the electron emission material layer includes a conductive material.

27. The method of claim 26, wherein the conductive material includes silver (Ag).

28. The method of claim 24, wherein the resistive material layer includes at least one of SiO_2 , MgO , a-Si, and p-Si.

29. The method of claim 24, wherein the resistive material layer is formed of one of a paste, a Sol-gel, or a slurry solution.

30. The method of claim 24, wherein the electron emission material layer includes a conductive material and is formed of one of a paste, a Sol-gel, or a slurry solution.

31. The method of claim 30, wherein the conductive material is silver (Ag).

32. The method of claim 24, wherein the electron emission material layer and the resistive material layer include a photoimageable resin.

5 33. The method of claim 24, wherein the isolation layer is formed using a solution where polyvinyl alcohol is added to an IPA diluted solution IPA/H₂O.

34. A method of manufacturing a field emission device, the method comprising:

10 (a) preparing a substrate structure in which a cathode electrode formed on a substrate, a gate insulating layer having a through hole through which part of the cathode electrode is exposed formed on the cathode electrode, and a gate electrode having a gate hole corresponding to the through hole formed on the gate insulating layer are sequentially stacked;

15 (b) forming a sacrificial layer on the surface of the substrate structure and on an inner wall of the through hole other than the cathode electrode exposed to the bottom of the through hole;

(c) forming a resistive material layer having an electrical resistivity on the sacrificial layer;

20 (d) forming an isolation layer that isolates the resistive material layer and an electron emission material layer formed on the resistive material layer from each other and does not react to at least one of the resistive material layer and the electron emission material layer;

25 (e) coating an electron emission material on the surface of the substrate structure on which the isolation layer is formed, to a predetermined thickness and forming an electron emission material layer for covering the through hole with the electron emission material;

30 (f) performing lift-off for removing the sacrificial layer formed on the surface of the gate electrode and on an inner wall of the through hole using an etchant, removing the resistive material layer formed on the sacrificial layer, the isolation layer, and the electron emission material, and forming an emitter formed of the resistive material layer and the electron emission material layer in an inner portion of the through hole; and

(g) firing the emitter.

35. The method of claim 34, wherein the electron emission material includes one of carbon nanotubes or nano particles.

36. The method of claim 34, wherein the electron emission material layer includes a conductive material.

37. The method of claim 36, wherein the conductive material includes silver (Ag).

38. The method of claim 34, wherein the resistive material layer includes at least one of SiO_2 , MgO , a-Si, and p-Si.

39. The method of claim 34, wherein the resistive material layer is formed of one of a paste, a Sol-gel, or a slurry solution.

40. The method of claim 34, wherein the electron emission material layer includes a conductive material and is formed of one of a paste, a Sol-gel, or a slurry solution.

41. The method of claim 40, wherein the conductive material is silver (Ag).

42. The method of claim 34, wherein the electron emission material layer and the resistive material layer include a photoimageable resin.

43. The method of claim 34, wherein the isolation layer is formed using a solution where polyvinyl alcohol is added to an IPA diluted solution IPA/ H_2O .